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MASS SPECTROMETRIC DETERMINATION OF THE COATING ENVIRONMENT IN PLASMA POLYMERIZATION UNDER ROUGH AND SMOOTH COATING CONDITIONS*

Raymond Brusasco, Gerald Wilemski, Stephen Letts, & Robert Cook

University of California
Lawrence Livermore National Laboratory
P.O. Box 808, Livermore, CA 94551

An understanding of the fundamental mechanisms underlying plasma polymerization, especially in connection with surface roughness evolution, would increase the applicability of this technology to advanced Inertial Confinement Fusion (ICF) target fabrication. Chemical reaction kinetics and surface diffusion modeling to describe film growth and roughness is aided by characterization of the gas phase coating environment with respect to the identity of species and their concentrations at the point of interaction with the substrate. Mass spectrometry is being used in this laboratory to characterize the plasma polymerization coating environment.

Evidence shows that coater deposits come from both the conversion of organic feed gas and plasma etching of polymer deposited in the silica plasma envelope. Mass spectral evidence will be presented to demonstrate this fact. The etching reaction favors the creation of lighter fragments to heavier ones. It is hypothesized that the etching reaction channels energy into the growing film interface and may play a role in determining the evolution of surface roughness via surface diffusion. A presentation of evidence for this and the correlation between the gas phase composition and surface roughness will be presented.

If deuterium is substituted for hydrogen during plasma polymer etching, it should be possible to ascertain the level of deuterium exchange with the surface and/or the liberated organic species. Any hypotheses regarding etch reaction pathways must be consistent with these data. Similar work with ^{13}C is also considered.

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